



Advanced Mirror Technology Development (AMTD) Project: Arnold Mirror Modeler Status and Use on 4-meter Design Trades

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Recent updates to the Arnold Mirror Modeler

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Arnold Mirror Modeler (AMM)

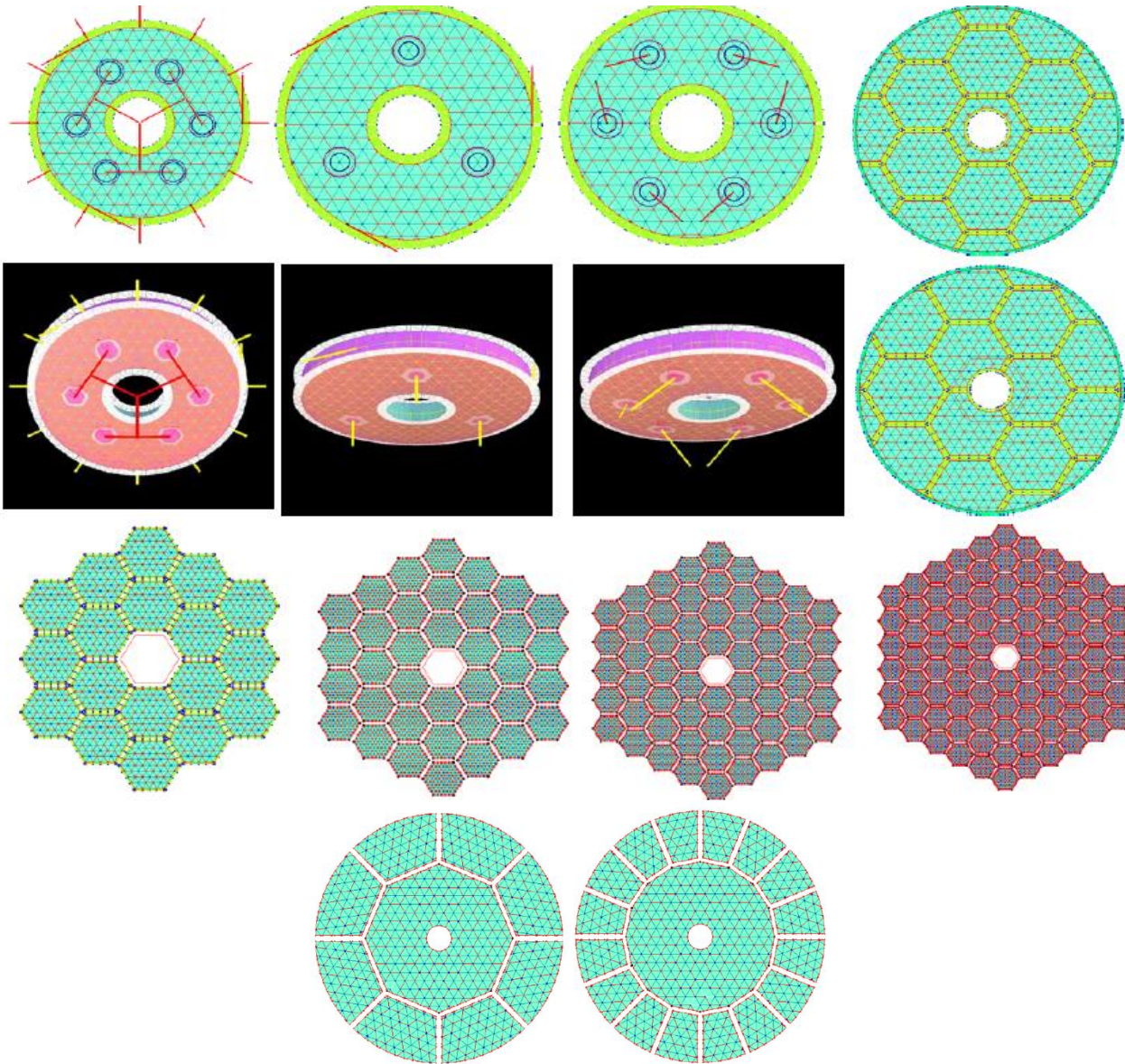
The AMM creates input decks for ANSYS, ABAQUS and NASTRAN. It creates a complete analysis stream, including model, loads [static and dynamic], plots and a summary file of input variable and results suitable for optimization or trade studies. The values of all settings in the program are archived and recalled to continue or redo any configuration.

Capabilities include:

- Monolithic and Segmented
- Hexapod and Hindle Support Mounts up to 18-point
- Launch Support System

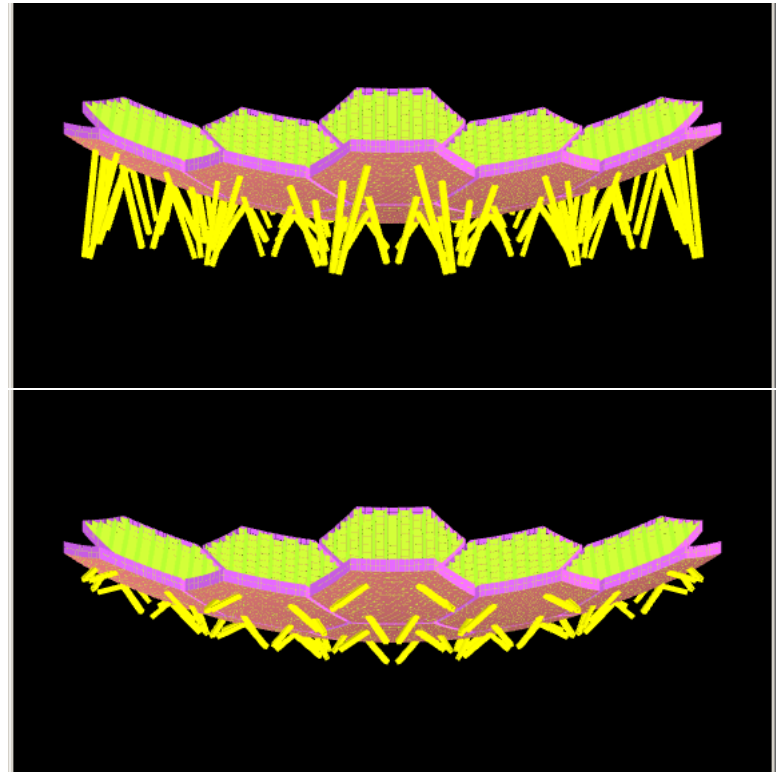
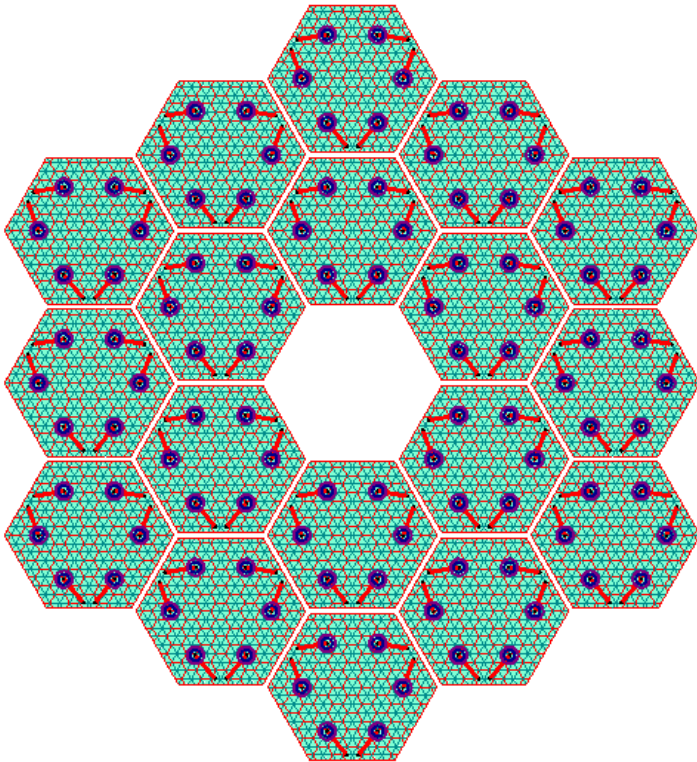


Monolithic and Segmented Apertures





Curved & Flat Back Hexapod Support Systems



As the segmented mirror sizes continue to grow, it becomes desirable to define the attachment plane for the segment support systems as a curve. This provides a more uniform strut stiffness for dynamic behavior of system.

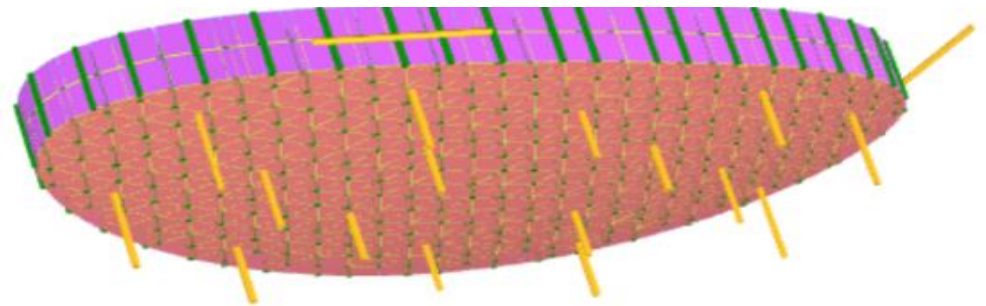
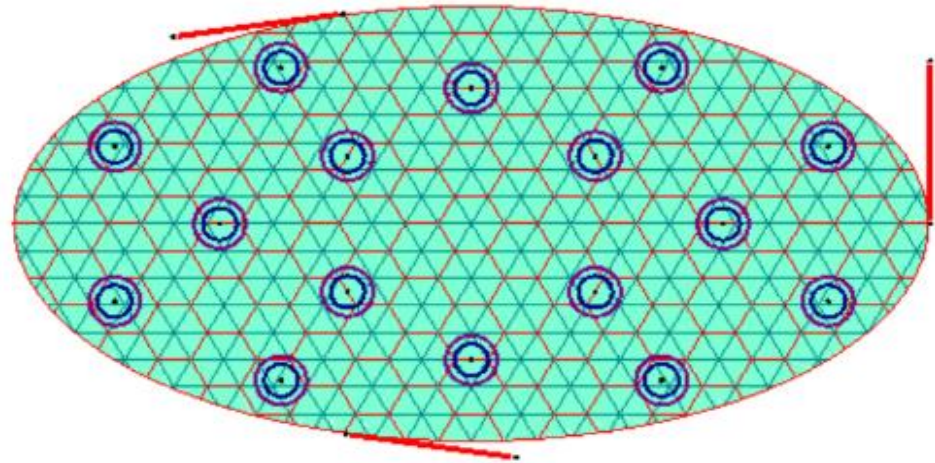
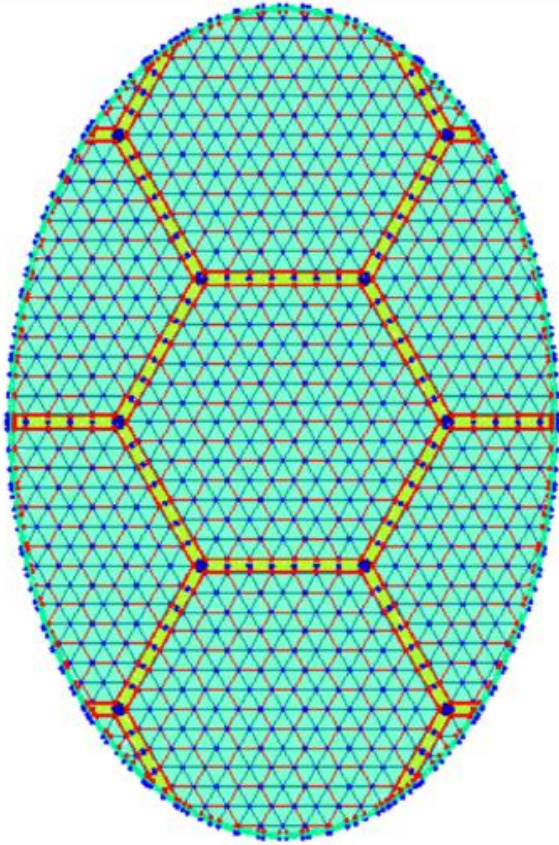


Changes Since Tech Days 2015

- Running check cases (needed to ‘release’) to insure consistent results for ANSYS, ABAQUS and NASTRAN uncovered multiple small ‘bugs’ whose ‘fixes’ were time consuming.
- Added Features
 - Elliptical Mirrors and Suspension System
 - Either Metric or English Unit Models
 - Zernike Support (Outputs Optical Surface Nodes & Displacements).
- Using for HabEx primary mirror trade studies
- Making Progress on Release
 - It has taken a very long time to navigate the NASA process for releasing code. There are multiple rules that must be satisfied.
 - ADA Compliant – to make usable by visually impaired individuals, added large help boxes.
 - ITAR – code must be encrypted; only available to US Gov Contractors.
 - Working on a ‘release’ User Manual
 - Quick Start and Full Manual
 - How To Tutorials (multi-segment, suspensions, hexapods, etc.)

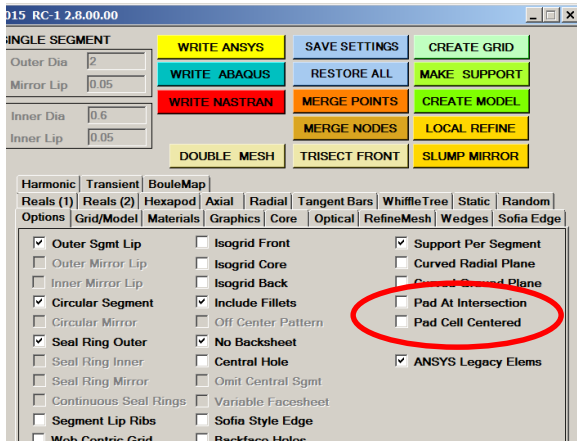


EXAMPLES OF ELLIPTICAL MIRRORS



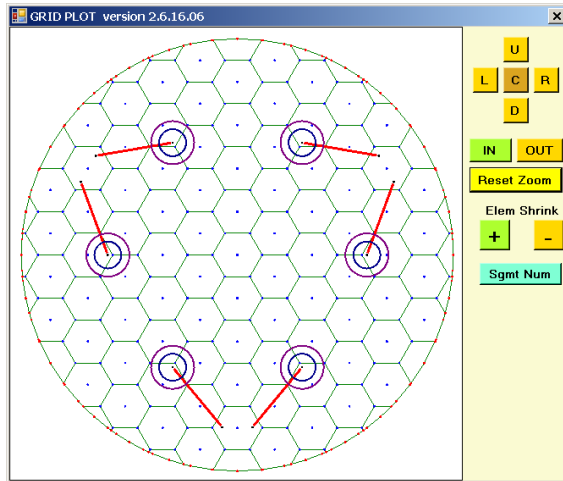


AUTOMATIC PAD REPOSITIONING

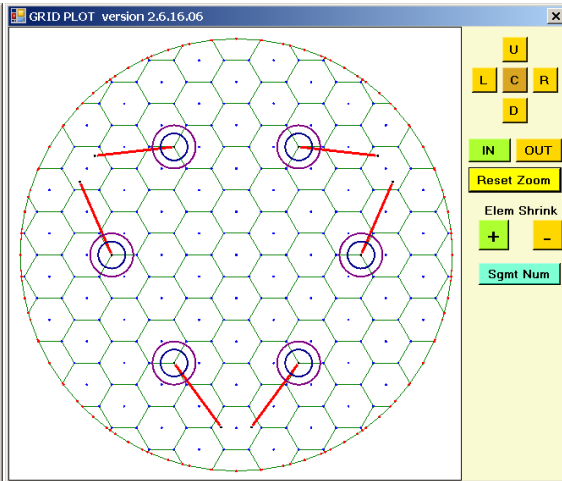


In addition to multiple simultaneous hexapod systems to support the wedge segments, it is now possible to force the pad locations to align exactly with either the center of a cell or the intersection of cell webs.

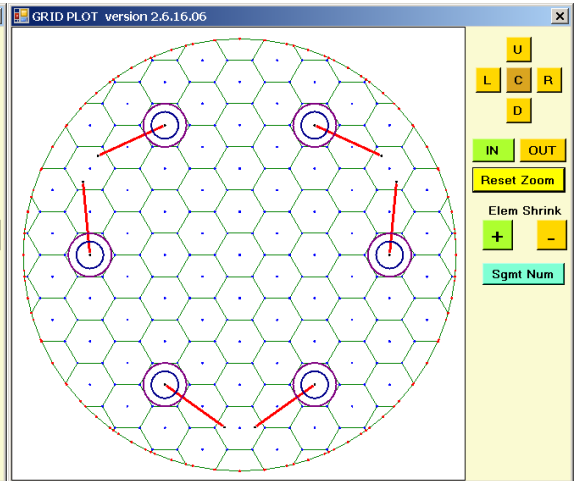
All it takes is checking the appropriate box!



INITIAL POSITION



CENTERED ON
INTERSECTION



CENTERED ON CELL
CENTER



ACKNOWLEDGEMENTS

A number of NASA interns have made major contributions to the development of the program, through their tireless efforts to break the code during testing and creative interruptions of the user's manual under development.

Jacob Vehonsky

Ryan M. Bevins

Matthew Fitzgerald

Rubin Jaca Rosa

Erik Humfleet



REFERENCES

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3. Arnold, W. R., Etal., “Next-generation lightweight mirror modeling software”, SPIE Opto-mechanical Engineering 2013, San Diego, CA SPIE 8836-15 (2013)
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5. Arnold, W. R., Etal. “Next-generation lightweight mirror modeling software”, NASA Mirror Tech Days 2013, Redondo Beach, CA (2013)